

CLAIMS

1. A method for producing noble metal/magnetic metal oxide composite fine particles comprising the steps of dispersing magnetic metal oxide fine particles in a solution containing a noble metal ion or a noble metal complex, or adding to the solution a metal ion that can form the magnetic metal oxide; and irradiating the resulting dispersion or solution with ultrasonic waves or ionizing radiation.

2. A method for producing noble metal/magnetic metal oxide composite fine particles comprising the steps of dispersing magnetic metal oxide fine particles in a solution containing a noble metal ion or a noble metal complex; and irradiating the dispersion with ultrasonic waves or ionizing radiation.

3. The method according to claim 1, wherein the noble ion or the noble metal complex comprises at least one metal selected from the group consisting of gold, silver, platinum, palladium, ruthenium, rhodium, iridium, and rhenium.

4. The method according to claim 1, wherein the solution containing the noble metal ion or noble metal complex is an aqueous solution, hydroalcoholic solution, or alcoholic solution.

5. The method according to claim 1, wherein the solution containing the noble metal ion or noble metal complex further contains at least one additive selected from the group consisting of water-soluble high-molecular-weight compounds, surfactants, and organic solvents.

6. The method according to claim 1, wherein the magnetic metal oxide fine particles are fine particles comprising at least one member selected from the group consisting of γ -Fe₂O₃ and Fe₃O₄.

7. The method according to claim 1, wherein the concentration of the noble metal ion or noble metal complex in the solution containing the noble metal ion or the noble metal complex is 1 μ M to 1 M; and the magnetic metal oxide fine particles are dispersed, or the metal ion that can form the magnetic metal oxide is added, in an amount of 0.001 to 50 wt.% relative to the solution.

8. The method according to claim 1, wherein the irradiation with ultrasonic waves is performed at a frequency of 10 kHz to 10 MHz and at an output of at least 1 W.

9. The method according to claim 1, wherein the irradiation with ionizing radiation is performed at an absorbed dose of at least 1 J/kg.

10. A method for producing noble metal/magnetic metal oxide composite fine particles comprising the steps of irradiating a solution containing a noble metal ion or a noble metal complex with ultrasonic waves or ionizing radiation; and adding to and mixing in the irradiated solution magnetic metal oxide fine particles.

11. Noble metal/magnetic metal oxide composite fine particles obtained according to the method set forth in claim 1.

12. The noble metal/magnetic metal oxide composite fine particles according to claim 11 that are magnetic and comprise magnetic metal oxide fine particles having a mean particle diameter of 1 nm to 1 μ m and noble metal nanoparticles having a mean particle diameter of 1 to 500 nm affixed to the surface of the magnetic metal oxide fine particles.

13. The noble metal/magnetic metal oxide composite fine

particles according to claim 11 that are colored and dispersible in a liquid solvent.

14. A substance in which noble metal/magnetic metal
5 oxide composite fine particles and linker molecules are bonded, which is a substance in which the noble metal/magnetic metal oxide composite fine particles according to claim 11 and linker molecules are bonded, and each linker molecule is bonded to a noble metal contained in one of the fine particles and has a
10 functional group that can chemically bond with a test substance.

15. The substance according to claim 14 which is an analytical reagent for a substance selected from the group consisting of pharmaceuticals, antigens, antibodies, receptors,
15 haptens, enzymes, proteins, peptides, nucleic acids, hormones, pathogens, and toxins.

16. The substance according to claim 14 which is a pharmaceutical, diagnostic agent, cell marker, enzyme fixative,
20 or protein refining agent.

17. The substance according to claim 14 for use in chromatography.

25 18. The substance according to claim 14 for use in soil modification, or water and air quality improvement.

19. The substance according to claim 14 for use as a catalyst, adsorbent, or sensor.